SAMPLE-HOLDER FOR DRAW AND HUMIDITY MEASUREMENT OF POROUS OBJECTS

The present invention pertains to a sample-holder able in particular to conduct measurement of the draw and humidity of porous objects such as cigarettes or similar.

Its subject is more particularly, but not exclusively, a sample-holder of said above type able to be integrated into a module for measuring the characteristics of cigarette batches, and designed so that it is able to carry out a sequence of measurements of weight, draw, filter ventilation, paper ventilation and compactness.

In said sequence the weight is generally measured firstly, while compactness is measured lastly, this measurement evidently being destructive.

Also, it is known that it is desirable, even essential, to determine a parameter relating to the humidity of the tobacco contained in the samples:

- This a data item of interest to cigarette manufacturers wishing to know the humidity content of cigarettes on leaving the production line.

- The weight and compactness of the cigarettes which are dependent upon humidity and must be expressed with respect to a reference humidity.
- It arises that the devices used for measuring humidity used up until now consist of independent modules which are inserted between two other modules of the production station.

However, it is ascertained that draw measurement (intermediate) causes a modification in tobacco humidity on account of the aspiration of an air stream through the cigarette. Consequently, the humidity of the tobacco sample in the weight measurement module and the humidity of the tobacco of this same sample in the compactness measurement module are different. If a single humidity module is used, only one of the two humidity values can be measured (before or after draw) since this characteristic is modified during measurement of draw. This therefore leads to errors.

To be able to avoid such errors, it is necessary to conduct measurement of humidity before draw to determine real humidity and to correct weight, then to conduct measurement of humidity after draw to correct compactness, which normally leads to the use of two humidity detection modules located either side of the draw module. Nonetheless, this solution is expensive and space-consuming.

The purpose of the invention is more particularly to overcome these drawbacks.

For this purpose, it proposes integrating a hyperfrequency cavity for measuring humidity within the draw measurement cell of the sample holder so as to be able to successively carry out measurement of humidity before draw (which enables weight correction), the measurement of draw and finally a second humidity measurement after draw to correct compactness accordingly.

Therefore, the device of the invention may comprise a tubular body comprising:

- an access orifice provided with an iris diaphragm enabling the top of the tobacco rod to be separated from the atmosphere so as to channel the flow of paper ventilation for its measurement,
- a cavity surrounding the tobacco rod, over at least a fraction of its height, so as to allow determination of tobacco humidity through the analysis of hyperfrequency signals, and
- at least a first sphincter with which to hold the cigarette by encapsulating the filter end over a standardized length, to perform draw measurements.

The distance between the iris diaphragm and the lower end of the sphincter being slightly shorter than the length of a cigarette.

Advantageously, said above body may comprise a second sphincter with which to encapsulate the filter opposite the first sphincter with respect to a filter ventilation zone so as to channel the flow of filter ventilation for its measurement.

With these arrangements, the sample holder alone can carry out a sequence successively comprising measurements of:

- humidity before draw (manufacturing humidity and humidity for weight correction),
- standardized draw TN,
- filter ventilation VF,
- paper ventilation VP,
- draw with filter ventilation closed TFE,
- humidity (for subsequent correction of compactness).

An embodiment of the invention is described below as a non-limitative example with reference to the appended drawing in which:

The single figure is an axial section of a sample-holder according to the invention.

In this example, the sample-holder 1 is intended to perform measurements on batches of cigarettes of which one cigarette, positioned on the sample holder, conventionally comprises a tobacco rod 2 contained in a cigarette paper wrapping 3 extended at one end by a ventilated filter 4 comprising, in its central part, an annular zone with ventilation holes 5.

This sample-holder 1 comprises a cylindrical structure made of three tubular parts 6, 7, 8 joined to each other with gas-tight assembly, namely:

a) a first part which forms a hopper comprising:
   - a tube 9 shouldered in its lower part,
   - a cylindrical sleeve 10 shouldered in its upper part which fits into shouldered tube 9 with a seal via an O-ring 11, the shoulder 12 comprising a radial air flow duct 13 used to channel and determine the flow rate QP of paper ventilation,
   - a hopper body 14 having an outer cylindrical surface which fits into sleeve 10 with a seal (O-Ring 15), this cylindrical surface in its lower part having a stage 16 of smaller diameter, followed by an end part of substantially flattened cone shape, and a coaxial central cavity comprising a part 17 of flattened cone shape followed in its lower part by a cylindrical part 18 whose diameter is substantially the diameter of the cigarette,
   - an iris diaphragm 19 mounted on the hopper body 14 with a seal by means of a cylindrical ring 20 which fits gas-tight onto stage 16 (O-ring 21), this iris diaphragm 19 comprising a coaxial opening which in its

retracted state has a diameter that is slightly smaller than the cigarette diameter;

b) a second part 7 delimiting a hyperfrequency cavity 6, this part comprising a cylindrical casing comprising a cylindrical wall 22 partly closed by two circular walls 23, 24 comprising two coaxial circular orifices in which the two respective ends of a tube in dielectric material 25 fit in sealed manner, the inner diameter of this tube being slightly larger than the cigarette diameter; the upper circular wall 23 is conformed for gas-tight assembly onto the shouldered part 12 of tube 9 delimiting, downstream from the iris diaphragm 19, a flow chamber into which the channel 13 opens; the lower circular face 24 of the casing carries a cylindrical coaxial fixation sleeve 26 whose diameter is greater than the diameter of the tube 25;

c) a third part 8 consisting of a section of tube shouldered in its lower part, this tube section 27 comprising a cylindrical central passage with different bore levels, namely: a first level whose diameter corresponds to the outer diameter of the sleeve 26 into which it fits with gas-tightness, a second bore level on which a first sphincter 28 is mounted which, in the released state, encapsulates the cigarette at the upper end of filter 4, a third bore level which delimits a cavity 29 surrounding the ventilation zone 5 of the filter 4 and into which a gas flow duct opens 30 whose flow rate QF determines the ventilation flow of filter 4, and a fourth bore level in which a second sphincter 31 is mounted which, in the deployed state under the effect of a pressurized gas, comes to encapsulate the lower end of the cigarette filter 4; as mentioned previously, this sphincter 31 holds the cigarette by encapsulating the filter end over a standardized length of 9 mm to perform draw and ventilation measurements.

The functioning of the above-described sample-holder is as follows:

During an initial phase the cigarette is inserted into the sample-holder 1. During this operation made simply under gravity, the cigarette centred by the hopper 14 (filter directed downwards) enters the passage delimited in particular by the cylindrical portion 18, the cylindrical tube 25 and the two sphincters 28, 31 which, with iris diaphragm 19, are then in a retracted state caused by aspiration. Telescopic abutment means then enable the cigarette to be held in the sample-holder 2, a position in which the lower end of the filter 4 is substantially located at the lower end of the sphincter 31, while the upper end of the tobacco rod 2 is located slightly above the iris diaphragm 19.

Sphincters 28, 31 and iris diaphragm 19 are then placed under atmospheric pressure and change to the deployed state so that:

- the iris diaphragm 19 separates the top of the tobacco rod 2 from the atmosphere,
- the sphincter 28 separates the filter part 4 from the tobacco rod 2,
- the sphincter 31 holds the cigarette in place by encapsulating the end of the filter 4 over a length of 9 mm.

The sample-holder 1 is then ready to perform its sequence of measurements, namely:

- a first humidity measurement by applying and analysing hyperfrequency signals in cavity C,
- a standardized draw measurement by causing an aspiration flow of 17.5 ml/s at the lower end of the filter 4, the flow channels of aspirated air being placed under atmospheric pressure; this measurement consists of using a pressure sensor to measure the load loss generated by the cigarette,
- a filter ventilation measurement using a first flow detector D_1 to measure the air flow QF passing through the channel 30,
- a paper ventilation measurement using a flow detector D_2 to measure the flow passing through channel 13,

- measurement of draw, through the cigarette, with the filter ventilation closed using the pressure sensor ΔP, channel 30 being closed by means of a controllable valve V_2,
- a further measurement of humidity using a processor MP similar to the one previously used.

Evidently, these different measurements may be piloted by a processor MP which also stores in memory the measured values and processes these values.

In this example, this microprocessor also controls:

- a valve V_1 closing the passage of the cigarette to the next station, in theory the cigarette diameter and compactness measuring station,
- a valve V_3 controlling closure of the atmospheric pressurizing of channel 19.

One important advantage of this solution is that, with the integration of the humidity measuring cavity within the draw module, it is possible to measure humidity before draw, to correct weight, and after draw to correct compactness using a single humidity sensor.